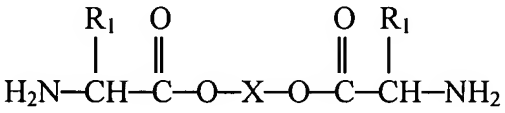
CLAIMS

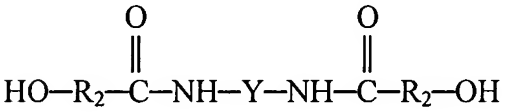
WHAT IS CLAIMED IS:

1. A medical article comprising an implantable substrate having a coating, the coating including a polymeric product of a reaction between a first reagent, a second reagent, and a third reagent, wherein:

(a) the first reagent is selected from a group consisting of compounds having formulae (1), (2), (3), and (4):



(1)



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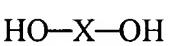
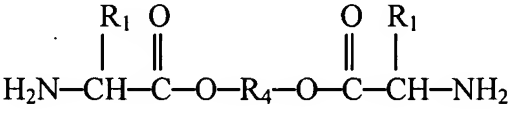


(3)

(4)

(b) the second reagent is selected from a group consisting of compounds having formulae (5), (6), (7), and (8):



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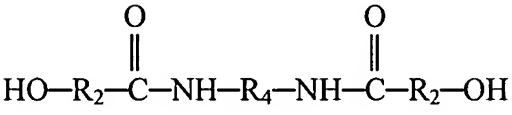

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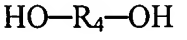
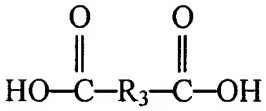


(7)

(8)

(c) the third reagent is a dicarboxylic acid having the formula (9):



(9)

wherein:

R_1 is hydrogen, methyl, *iso*-propyl, *sec*-butyl; *iso*-butyl, or benzyl group;

R_2 is methylene, methylmethylene, *n*-propylene, *iso*-propylene, ethylmethylene, *n*-butylene, *iso*-butylene, *sec*-butylene, or *n*-amylene group;

R_3 is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12;

R_4 is a moiety derived from a compound selected from a group consisting of poly(ethylene glycol), poly(propylene glycol), random poly(ethylene glycol-co-propylene glycol), poly(ethylene glycol)-block-poly(propylene glycol), hyaluronic acid, poly(2-hydroxyethyl methacrylate), poly(3-hydroxypropylmethacrylamide), poly(styrene sulfonate), poly(vinyl pyrrolidone), and cellulosics;

X is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12; and

Y is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is 1, 2, or 5.

2. The medical article of Claim 1, wherein the implantable substrate is a stent.

3. The medical article of Claim 1, wherein the compound of formula (1) is a diol-diamine, the diol-diamine is a product of condensation of an amino acid and a diol.

4. The medical article of Claim 3, wherein the amino acid has the formula (10):

$H_2N—CHR_1—COOH.$ (10)

5. The medical article of Claim 3, wherein the amino acid is selected from a group consisting of glycine, alanine, valine, isoleucine, leucine, and phenyl alanine.

6. The medical article of Claim 3, wherein a diol is selected from a group consisting of ethylene glycol, 1,3-propanediol, 1,4-butane diol, 1,5-pentanediol, 1,6-hexanediol, 1,7-heptanediol, 1,8-octanediol, 1;9-nonanediol, 1,10-decanediol, 1,11-undecanediol, and 1,12-dodecanediol.

7. The medical article of Claim 1, wherein the compound of formula (2) is an amidediol, the amidediol is a product of condensation of a hydroxy acid and a diamine.

8. The medical article of Claim 7, wherein the hydroxy acid has the formula (11):

$HO—R_2—COOH.$ (11)

9. The medical article of Claim 7, wherein the hydroxy acid is selected from a group consisting of glycolic acid, lactic acid, β-hydroxybutyric acid, α-hydroxyvaleric acid, and ε–hydroxycaproic acid.

10. The medical article of Claim 7, wherein the diamine is selected from a group consisting of putrescine, 1,2-ethanediamine, and cadavarene.

11. The medical article of Claim 1, wherein the compound of formula (3) is selected from a group consisting of ethylene glycol, 1,3-propanediol, 1,4-butane diol, 1,5-pentanediol, 1,6-hexanediol, 1,7-heptanediol, 1,8-octanediol, 1,9-nonanediol, 1,10-decanediol, 1,11-undecanediol, and 1,12-dodecanediol.

12. The medical article of Claim 1, wherein the compound of formula (4) is selected from a group consisting of putrescine, 1,2-ethanediamine, and cadavarene.

13. The medical article of Claim 1, wherein the compound of formula (5) is a PEG-diester-diamine conjugate, the conjugate is a product of condensation of an amino acid and poly(ethylene glycol).

14. The medical article of Claim 13, wherein the amino acid has the formula (10):

$$H_2N—CHR_1—COOH. \quad (10)$$

15. The medical article of Claim 13, wherein the amino acid is selected from a group consisting of glycine, alanine, valine, isoleucine, leucine, phenyl alanine, tyrosine, serine, and glutamic acid.

16. The medical article of Claim 1, wherein the compound of formula (6) is a PEG-amidediol conjugate, the conjugate is a product of condensation of a hydroxy acid and PEG-diamine.

17. The medical article of Claim 16, wherein the hydroxy acid has the formula (11):

$$HO—R_2—COOH. \quad (11)$$

18. The medical article of Claim 17, wherein the hydroxy acid is selected from a group consisting of glycolic acid, lactic acid, β-hydroxybutyric acid, α-hydroxyvaleric acid, and ε–hydroxycaproic acid.

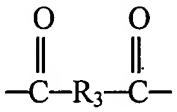
19. A medical article comprising an implantable substrate having a coating, the coating including a copolymer having a general formula (12) or (13):

$$-[M-P]_m-[M-Q]_n- \quad (12)$$

$$-[M_1-P]_p- \quad (13)$$

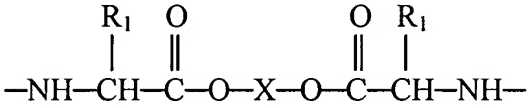
wherein:

M is a moiety represented by the structure having the formula (14)



(14)

P is a moiety selected from a group consisting of structures having the formulae (15), (16), (17), and (18):



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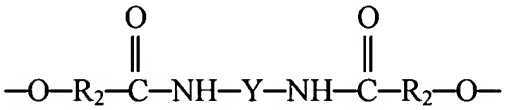
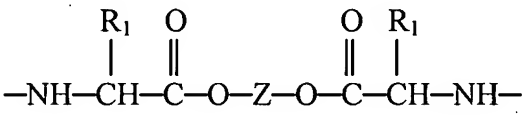


(16)

$$-O-X-O- \quad (17)$$

$$-NH-Y-NH- \quad (18)$$

Q is a moiety selected from a group consisting of structures having the formulae (19), (20), and (21)



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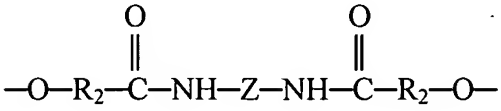
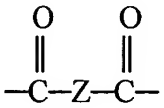


(20)

$$-O-Z-O-, \text{ and } -NH-Z-NH- \quad (21)$$

M_1 is a moiety represented by the structure having the formula (22):



(22)

R_1 is hydrogen, methyl, *iso*-propyl, *sec*-butyl; *iso*-butyl, or benzyl group;

R_2 is methylene, methylmethylene, *n*-propylene, *iso*-propylene, ethylmethylene, *n*-butylene, *iso*-butylene, *sec*-butylene, or *n*-amylene group;

R_3 is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12;

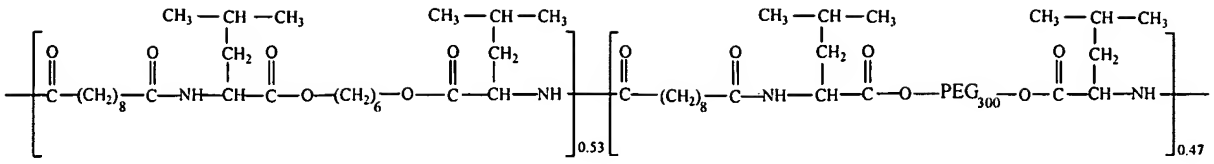
X is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12;

Y is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is 1, 2, or 5;

Z is a moiety derived from a compound selected from a group consisting of poly(ethylene glycol), poly(propylene glycol), random poly(ethylene glycol-co-propylene glycol), poly(ethylene glycol)-block-poly(propylene glycol), hyaluronic acid, poly(2-hydroxyethyl methacrylate), poly(3-hydroxypropylmethacrylamide), poly(styrene sulfonate), poly(vinyl pyrrolidone, and cellulosics; and

m, n, and p are integers where the value of m is between 5 and 1,800, the value of n is between 1 and 800 and the value of p is between 4 and 1,500.

20. The medical article of Claim 19, wherein the polymer is selected from a group consisting of copolymers of formulae (23), (24), (25), (26), (27), (28), (29), (30), (31), (32), (33), (34), (35), (36), (37), (38), (39), (40), (41), (42), and (43):



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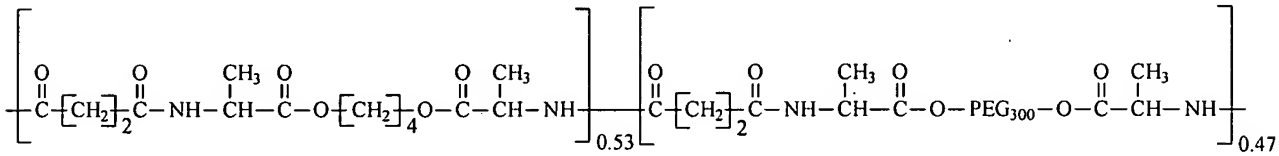

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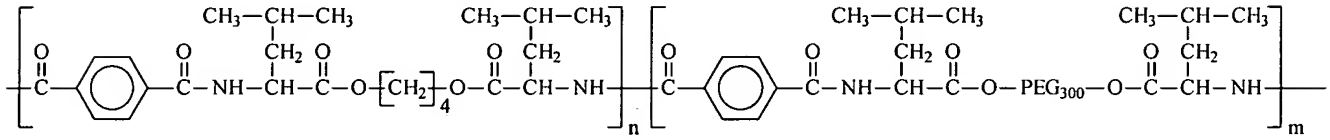

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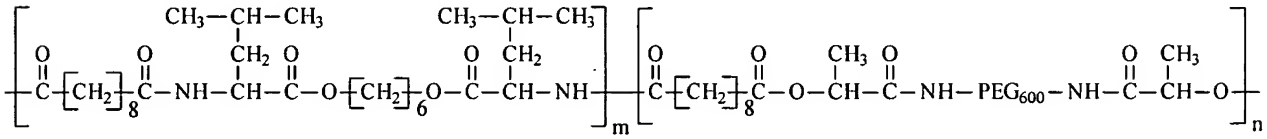

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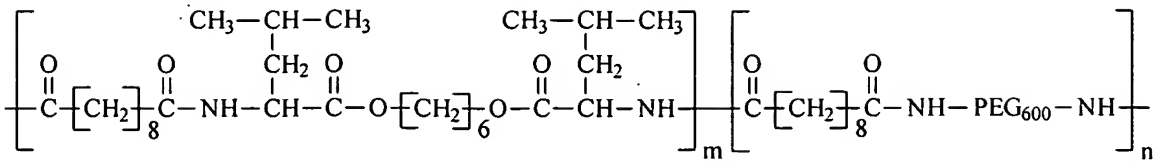

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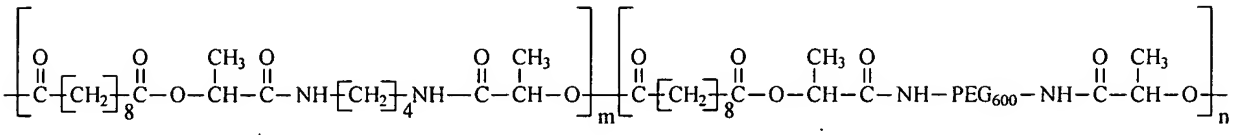

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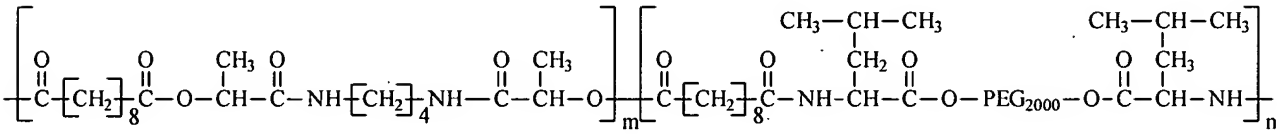

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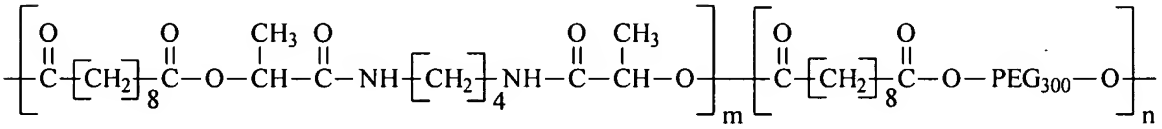

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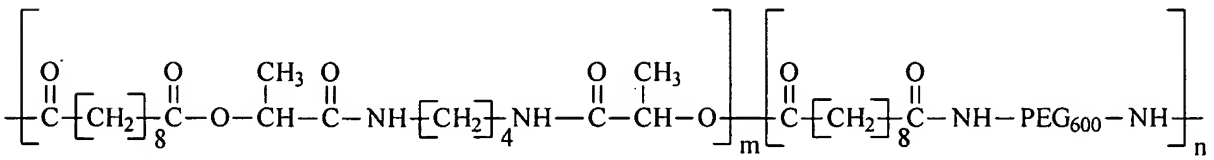

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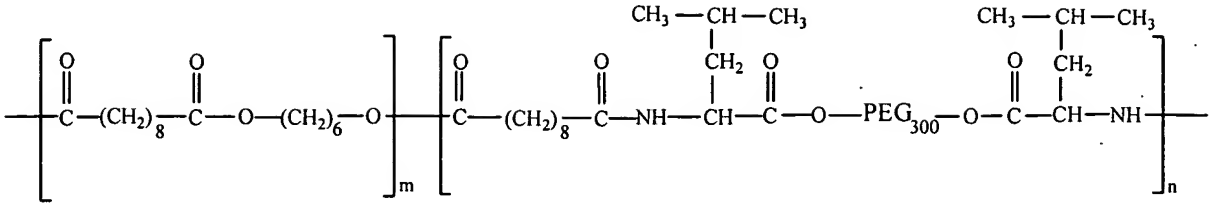

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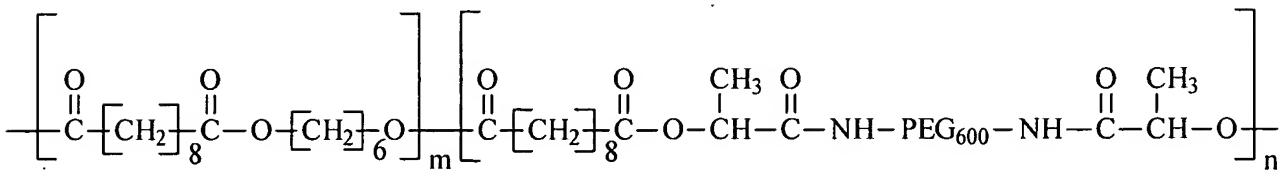

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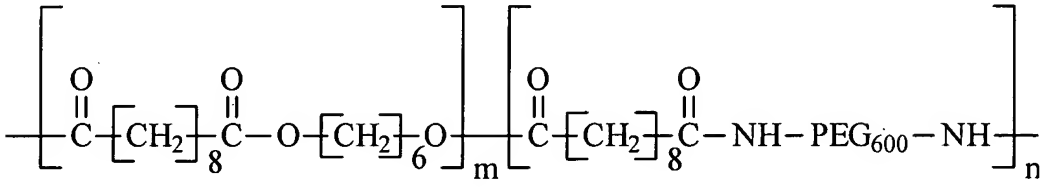

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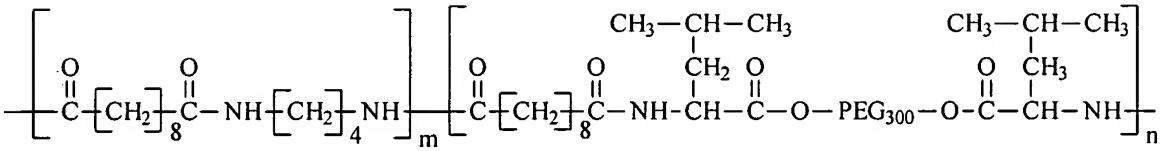

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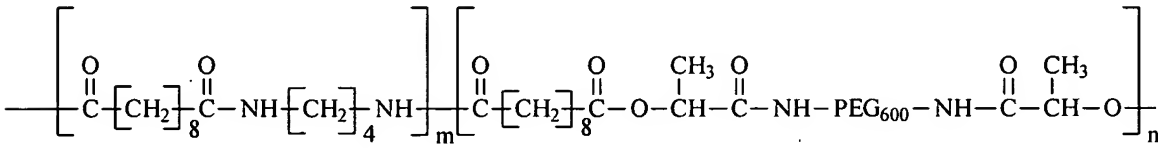

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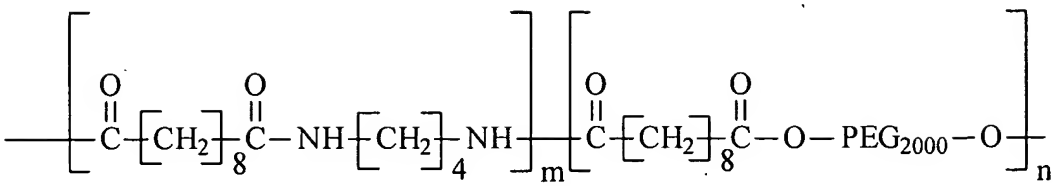

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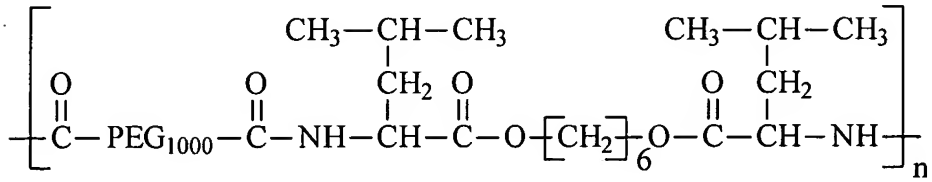

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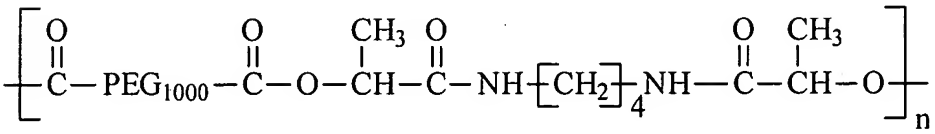

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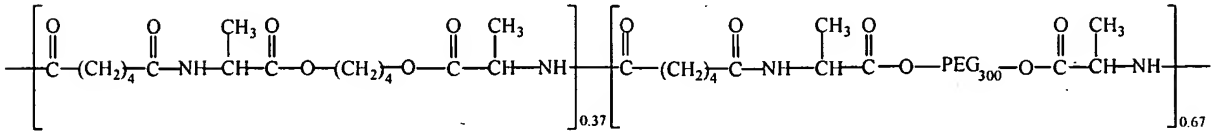

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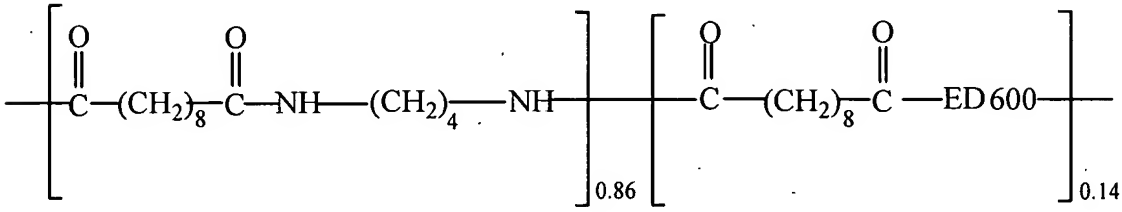

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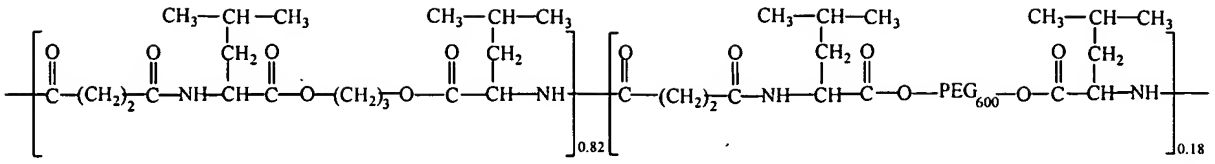

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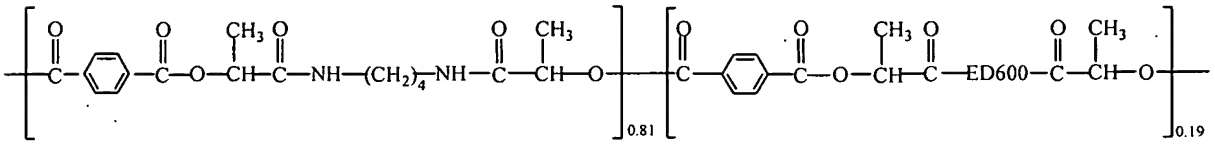
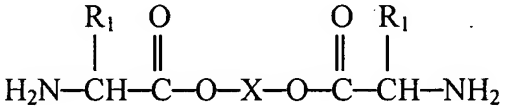


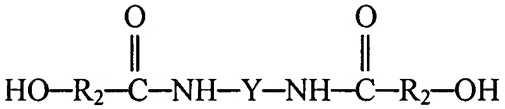
(43)

21. A method for fabricating a medical article, the method including synthesizing a copolymer and forming a coating based on the copolymer on at least a portion of an implantable substrate, the synthesizing of the copolymer including reacting a first reagent with a second reagent and with a third reagent, wherein:

(a) the first reagent is selected from a group consisting of compounds having formulae (1), (2), (3), and (4):



(1)



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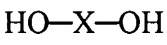

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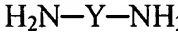
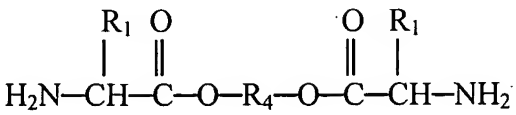


(4)

(b) the second reagent is selected from a group consisting of compounds having formulae (5), (6), (7), and (8):



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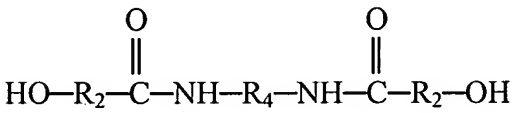

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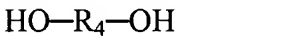

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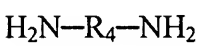
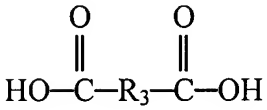


(8)

(c) the third reagent is a dicarboxylic acid having the formula (9):



(9)

wherein:

R_1 is hydrogen, methyl, *iso*-propyl, *sec*-butyl; *iso*-butyl, or benzyl group;

R_2 is methylene, methylmethylene, *n*-propylene, *iso*-propylene, ethylmethylene, *n*-butylene, *iso*-butylene, *sec*-butylene, or *n*-amylene group;

R_3 is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12;

R_4 is a moiety derived from a compound selected from a group consisting of poly(ethylene glycol), poly(propylene glycol), random poly(ethylene glycol-co-propylene glycol), poly(ethylene glycol)-block-poly(propylene glycol), hyaluronic acid, poly(2-hydroxyethyl methacrylate), poly(3-hydroxypropylmethacrylamide), poly(styrene sulfonate), poly(vinyl pyrrolidone), and cellulosics;

X is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12;

Y is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is 1, 2, or 5.

22. The method of Claim 21, wherein the implantable substrate is a stent.

23. The method of Claim 21, wherein the molar ratio between the first reagent, the second reagent, and the third reagent is about 1:1:2.

24. The method of Claim 21, wherein the compound of formula (1) is a diol-diamine, the diol-diamine is a product of condensation of an amino acid and a diol.

25. The method of Claim 24, wherein the amino acid has the formula (10):

$$H_2N—CHR_1—COOH. \quad (10)$$

26. The method of Claim 24, wherein the amino acid is selected from a group consisting of glycine, alanine, valine, isoleucine, leucine, and phenyl alanine.

27. The method of Claim 24, wherein a diol is selected from a group consisting of ethylene glycol, 1,3-propanediol, 1,4-butane diol, 1,5-pentanediol, 1,6-hexanediol, 1,7-heptanediol, 1,8-octanediol, 1,9-nonanediol, 1,10-decanediol, 1,11-undecanediol, and 1,12-dodecanediol.

28. The method of Claim 21, wherein the compound of formula (2) is an amidediol, the amidediol is a product of condensation of a hydroxy acid and a diamine.

29. The method article of Claim 28, wherein the hydroxy acid has the formula (11):

$HO—R_2—COOH.$ (11)

30. The method of Claim 28, wherein the hydroxy acid is selected from a group consisting of glycolic acid, lactic acid, β-hydroxybutyric acid, α-hydroxyvaleric acid, and ε–hydroxycaproic acid.

31. The method of Claim 28, wherein the diamine is selected from a group consisting of putrescine, 1,2-ethanediamine, and cadavarene.

32. The method of Claim 21, wherein the compound of formula (3) is selected from a group consisting of ethylene glycol, 1,3-propanediol, 1,4-butane diol, 1,5-pentanediol, 1,6-hexanediol, 1,7-heptanediol, 1,8-octanediol, 1,9-nonanediol, 1,10-decanediol, 1,11-undecanediol, and 1,12-dodecanediol.

33. The method of Claim 21, wherein the compound of formula (4) is selected from a group consisting of putrescine, 1,2-ethanediamine, and cadavarene.

34. The method of Claim 21, wherein the compound of formula (5) is a PEG-diester-diamine conjugate, the conjugate is a product of condensation of an amino acid and poly(ethylene glycol).

35. The method of Claim 34, wherein the amino acid has the formula (10):

$H_2N—CHR_1—COOH.$ (10)

36. The method of Claim 34, wherein the amino acid is selected from a group consisting of glycine, alanine, valine, isoleucine, leucine, phenyl alanine, tyrosine, serine, and glutamic acid.

37. The method of Claim 21, wherein the compound of formula (6) is a PEG-amidediol conjugate, the conjugate is a product of condensation of a hydroxy acid and PEG-diamine.

38. The method of Claim 37, wherein the hydroxy acid has the formula (11):

$$HO{-}R_2{-}COOH. \qquad (11)$$

39. The method of Claim 37, wherein the hydroxy acid is selected from a group consisting of glycolic acid, lactic acid, β-hydroxybutyric acid, α-hydroxyvaleric acid, and ε–hydroxycaproic acid.

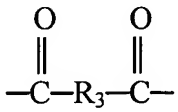
40. A method for fabricating a medical article, the method including synthesizing a copolymer and forming a coating based on the copolymer on at least a portion of an implantable substrate, wherein the copolymer has a general formula (12) or (13):

$$-[M{-}P]_m{-}[M{-}Q]_n- \qquad (12)$$

$$-[M_1{-}P]_p- \qquad (13)$$

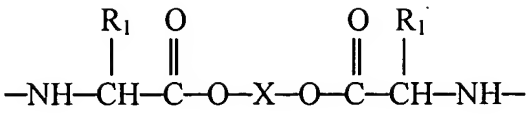
wherein:

M is a moiety represented by the structure having the formula (14)



(14)

P is a moiety selected from a group consisting of structures having the formulae (15), (16), (17), and (18):



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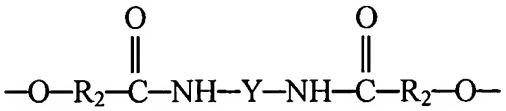

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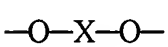

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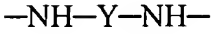
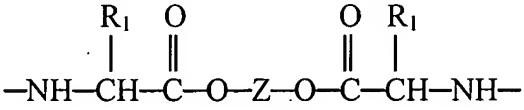


(18)

Q is a moiety selected from a group consisting of structures having the formulae (19), (20), and (21)



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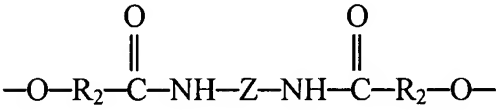

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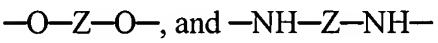
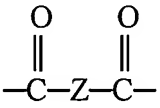


(21)

M_1 is a moiety represented by the structure having the formula (22):



(22)

R_1 is hydrogen, methyl, *iso*-propyl, *sec*-butyl; *iso*-butyl, or benzyl group;

R_2 is methylene, methylmethylene, *n*-propylene, *iso*-propylene, ethylmethylene, *n*-butylene, *iso*-butylene, *sec*-butylene, or *n*-amylene group;

R_3 is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12;

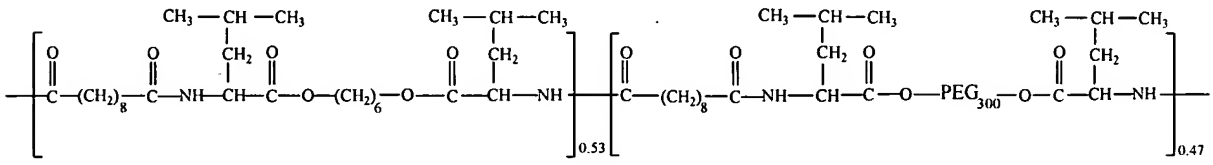
X is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is an integer between 2 and 12;

Y is a straight chained or branched aliphatic alkylene group C_nH_{2n}, wherein n is 1, 2, or 5; and

Z is a moiety derived from a compound selected from a group consisting of poly(ethylene glycol), poly(propylene glycol), random poly(ethylene glycol-co-propylene glycol), poly(ethylene glycol)-block-poly(propylene glycol), hyaluronic acid, poly(2-hydroxyethyl methacrylate), poly(3-hydroxypropylmethacrylamide), poly(styrene sulfonate), poly(vinyl pyrrolidone, and cellulosics; and

m, n, and p are integers where the value of m is between 5 and 1,800, the value of n is between 1 and 800 and the value of p is between 4 and 1,500.

41. The method of Claim 40, wherein the copolymer is selected from a group consisting of copolymers of formulae (23), (24), (25), (26), (27), (28), (29), (30), (31), (32), (33), (34), (35), (36), (37), (38), (39), (40), (41), (42), and (43):



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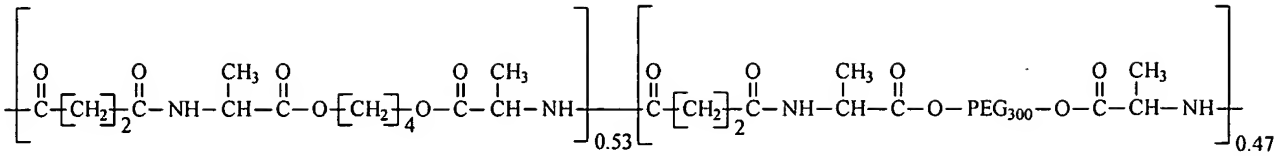

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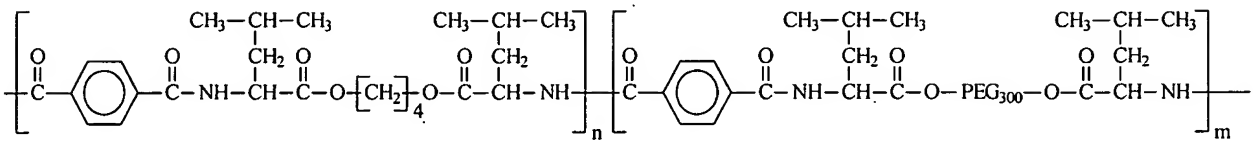

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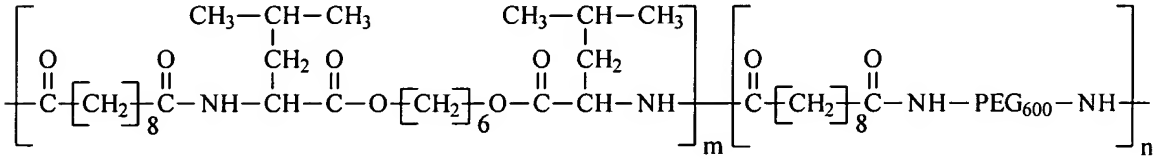

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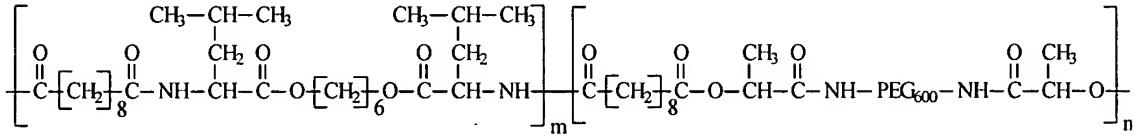

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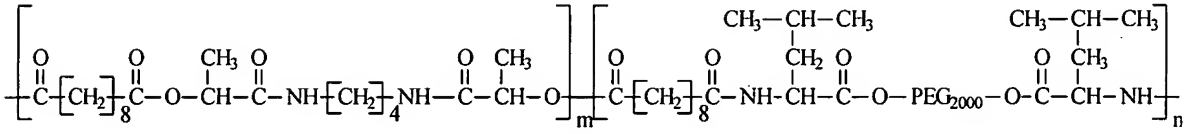

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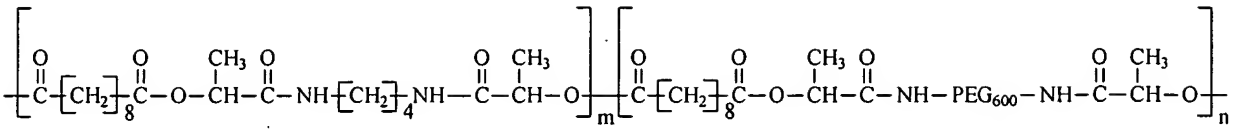

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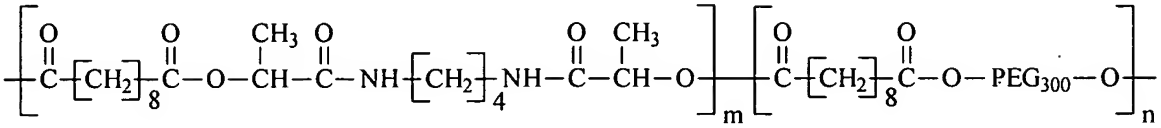

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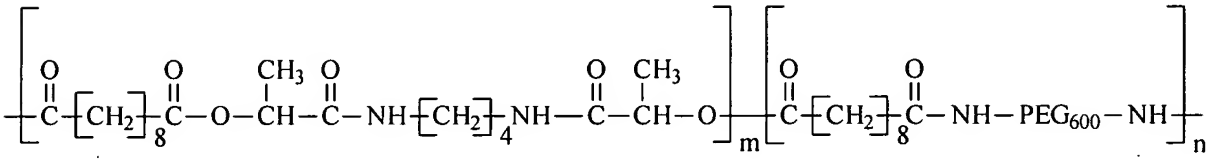

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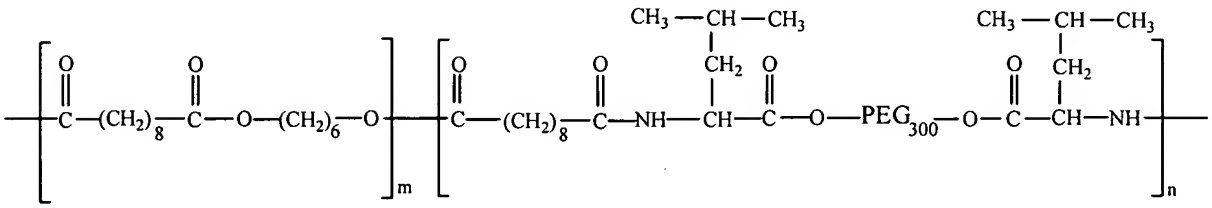

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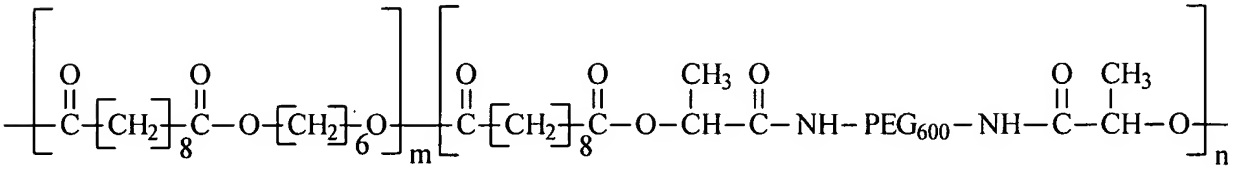

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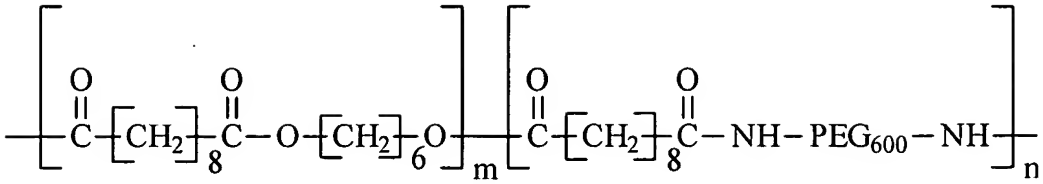

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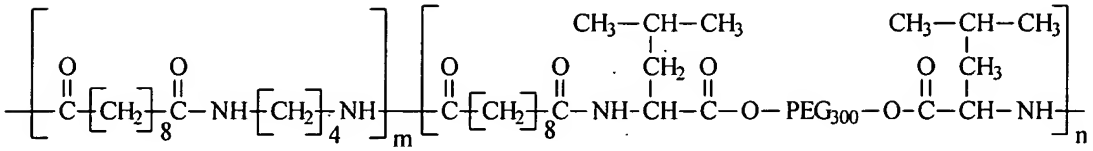

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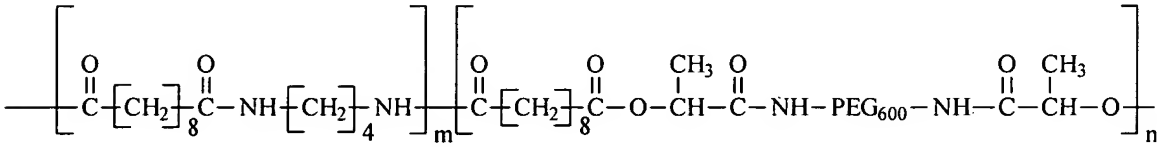

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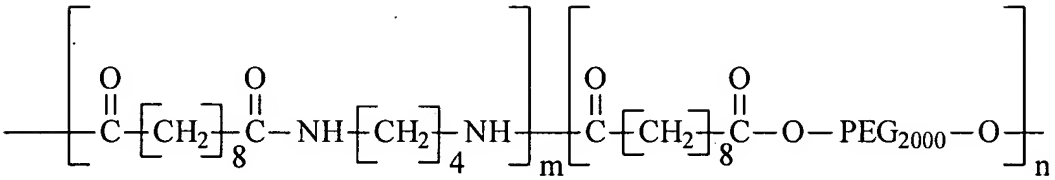

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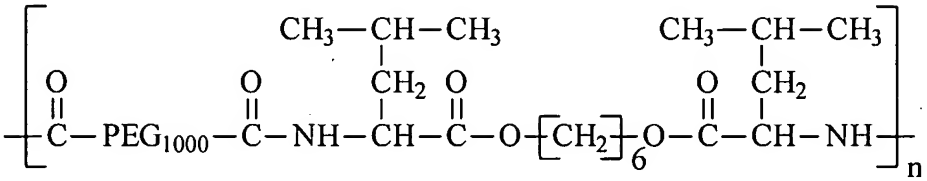

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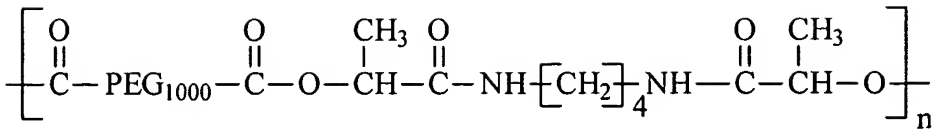

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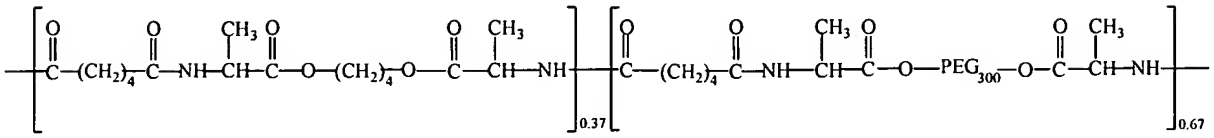

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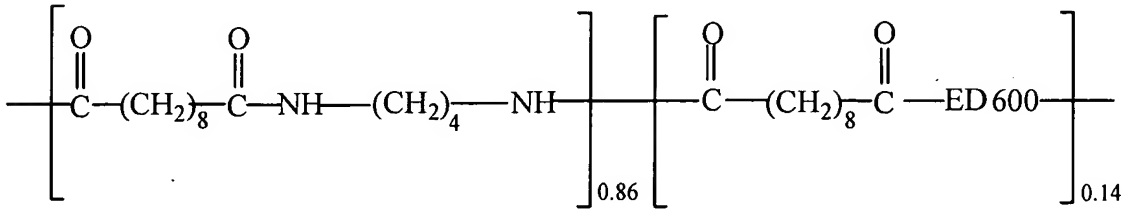

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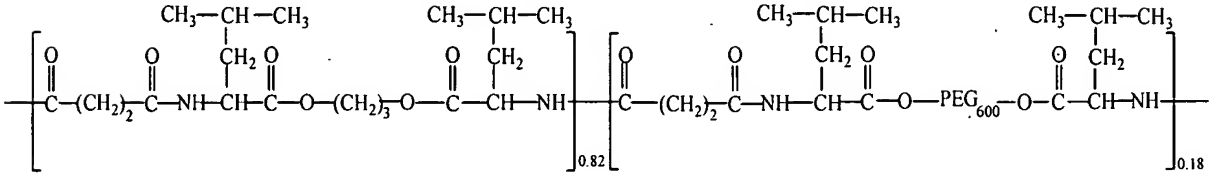

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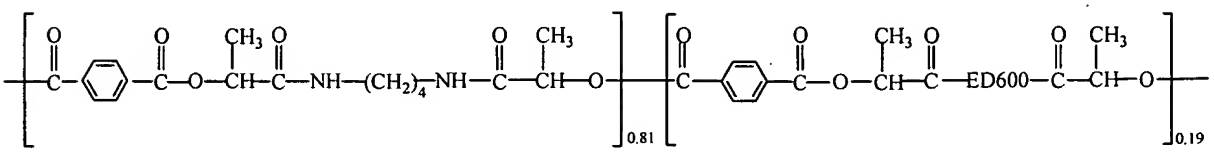

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